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Laboratory grows world record length carbon nanotube

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LOS ALAMOS, N.M., Sept. 13, 2004 -- University of California scientists working at Los Alamos National Laboratory in collaboration with chemists from Duke University have recently grown a world record-length four-centimeter-long, single-wall carbon nanotube.

Single-wall carbon nanotubes have a number of revolutionary uses, including being spun into fibers or yarns that are more than 10 times stronger than any current structural material. In addition to uses in lightweight, high-strength applications, these new long metallic nanotubes also will enable new types of nanoscale electro-mechanical systems such as micro-electric motors, nanoscale diodes, and nanoconducting cable for wiring micro-electronic devices.

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In research reported in the current online issue of the journal Nature Materials, Yuntian Zhu and his colleagues discuss how they created a single-wall carbon nanotube using a process called catalytic chemical vapor deposition from ethanol (alcohol) vapor. Discovered in 1991 by Japanese scientist Sumio Iijima, carbon nanotubes are cylindrical carbon molecules that are very similar in structure to a fullerene, or buckyball, but instead of being a sphere, the nanotube is tubular in shape. Until the advent of the Los Alamos/Duke discovery, the length of carbon nanotubes had previously been limited to a few millimeters.

Zhu, a scientist in the Materials Science and Technology Division, said, "although this discovery is really only a beginning, the continued development of longer length carbon nanotubes could result in nearly endless applications. Actually, the potential uses for long carbon nanotubes are probably limited only by our imagination."

Long metallic carbon nanotubes can be used to create a bio/chemical sensor in one segment while the rest of the nanotube can act as a conductor to transmit the

signal. Other uses include applications in nanoscale electronics, where the nanotubes can be used as conducting or insulating materials. For example, joining together two nanoscale carbon tubes with differing electronic properties could create nanoscale diodes. Even more promising are uses that take advantage of the astonishing strength of the tubes, such as in the creation of super strong carbon nanotube yarns.

In addition to Zhu, other members of the nanotube team included Lianxi Zheng, Michael O'Connell, Stephen Doorn, Yonghao Zhao, Elshan Akhadov, Mark A. Hoffbauer, Bobbi Roop, Quanxi Jia, Robert Dye and Dean Peterson from Los Alamos and Shaoming Huang and Jie Liu from the Chemistry Department at Duke University in Durham, N.C.

The research was conducted under the auspices of the Los Alamos Superconductivity Technology Center with funding from the Los Alamos Laboratory-Directed Research and Development (LDRD) program. LDRD funds basic and applied research and development focusing on employee-initiated creative proposals selected at the discretion of the Laboratory director.

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